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भारतीय मानक  
मीट्रिक बट्रेस चूड़ियों के लिए आयाम

भाग 4 छूट प्रणाली  
( दूसरा पुनरीक्षण )

*Indian Standard*

**DIMENSIONS FOR METRIC BUTTRESS THREADS**

**PART 4 TOLERANCING SYSTEM**

*( Second Revision )*

ICS 21.040.10

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**BUREAU OF INDIAN STANDARDS**  
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## FOREWORD

This Indian Standard (Part 4) (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Engineering Standards Sectional Committee had been approved by the Medical Instruments, General and Production Engineering Division Council.

This standard was first published in 1968 and was revised in 1976 splitting up into four parts. The other parts in this series are:

- |                 |                            |
|-----------------|----------------------------|
| (Part 1) : 1976 | Basic and design profile   |
| (Part 2) : 1976 | Pitch diameter combination |
| (Part 3) : 1976 | Basic dimensions           |

The title of the standard in general has also been modified in line with DIN 513.

The earlier edition of this Part 4 was in line with DIN 513 - 1975. In the preparation of this revision considerable assistance has been derived from latest edition of DIN 513, Sheet 3 - 1985 'Metrisches Sägewinde, Abmaße und Toleranzen (Metric buttress threads, deviations and tolerances)', issued by DIN, Deutsches Institut für Normung, and has been brought in line with it.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

# Indian Standard

## DIMENSIONS FOR METRIC BUTTRESS THREADS

### PART 4 TOLERANCING SYSTEM

### ( Second Revision )

#### 1 SCOPE

This standard (Part 4) specifies the tolerancing system for metric buttress threads in the diameter range M 10 to M 640 mm.

#### 2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	Title
919 (Part 1) : 1993	ISO system of limits and fits: Part 1 Bases of tolerance, deviations and fits ( <i>second revision</i> )
4696 (Part 2) : 2004	Dimensions for metric buttress threads: Part 2 Pitch diameter combinations ( <i>second revision</i> )

#### 3 DESIGNATION

3.1 The complete screw threads designation shall consist of a size designation and tolerance class designation.

##### 3.1.1 Size Designation

See 4 of IS 4696 (Part 2).

##### 3.1.2 Tolerance Class Designation

This shall include a class designation for the pitch diameter tolerance only since the crest diameters (minor diameter for internal threads and major diameter for internal and external threads) have only one tolerance class specified. Each class designation shall consist of:

- a numeral indicating tolerance grade; and
- a letter indicating tolerance position, capital for internal threads, small for external threads.

Examples:

ST 40 × 7 – 7H

ST 40 × 7 – 7e

A fit between threaded parts is indicated by the internal threads tolerance class followed by the external threads tolerance class separated by a solidus.

Example:

ST 40 × 7 – 7H/7e

Multiple start threads conforming to this standard shall be designated as follows:

Examples:

ST 40 × 14(7) – 7H

ST 40 × 14(7) – 7e       $\frac{\text{Lead}}{\text{Pitch}} = \frac{14}{7}$

(Number of starts) =      =

#### 4 STRUCTURE OF THE TOLERANCING SYSTEM

The structure of the tolerancing system gives tolerances defined by tolerance grades and tolerance position.

##### 4.1 Tolerance Grades

The following tolerance grades are provided for major, pitch and minor diameters:

Diameter	Tolerance Grade
Major diameter of internal threads, $D$	H10 <sup>1)</sup>
Major diameter of external threads, $d$	9, h9 <sup>1)</sup>
Minor diameter of internal threads, $D_1$	4
Minor diameter of external threads, $d_3$	7, 8, 9
Pitch diameter of internal threads, $D_2$	7, 8, 9
Pitch diameter of external threads, $d_2$	7, 8, 9

<sup>1)</sup> Tolerance according to IS 919 (Part 1).

4.2 Tolerance Positions

The following tolerance positions are provided (see Fig. 1 and Fig. 2).

4.2.1 External Threads

*c* for pitch diameter tolerance and *h* in all cases for the tolerance of major and minor diameters. The fundamental deviation for these two diameters is always zero.

4.2.2 Internal Threads

The fundamental deviation for major pitch and minor diameter is always present. Thus only the tolerance position *H* is specified.

4.2.3 Fundamental Deviations

The fundamental deviation *A*<sub>0</sub> for the pitch diameter of external threads is given in Table 1.

4.2.3.1 The above deviations are calculated from the formula:

$A_0(c) = -(125 + 11P) \mu\text{m}$ , for  $P = 2 \text{ mm}$

$A_0(c) = -630 \mu\text{m}$ , for  $P = 44 \text{ mm}$

NOTE — The values for *es* for the intermediate pitches in Table 1 have been determined by practical experience.

5 LENGTH OF THREADS ENGAGEMENT

5.1 The length of threads engagement is divided into two groups as normal (*N*) and long (*L*) and are given in Table 2.

Table 1 Fundamental Deviations *A*<sub>0</sub> for External Threads (Clause 4.2.3)

Pitch <i>P</i> mm	Upper Deviation, <i>es</i>	
	<i>c</i>	<i>e</i>
2	- 150	- 71
3	- 170	- 85
4	- 190	- 95
5	- 212	- 106
6	- 236	- 118
7	- 250	- 125
8	- 265	- 132
9	- 280	- 140
10	- 300	- 150
12	- 335	- 170
14	- 355	- 180
16	- 375	- 190
18	- 400	- 200
20	- 425	- 212
22	- 450	- 224
24	- 475	- 236
28	- 500	- 250
32	- 530	- 265
36	- 560	- 280
40	- 600	- 300
44	- 630	- 315

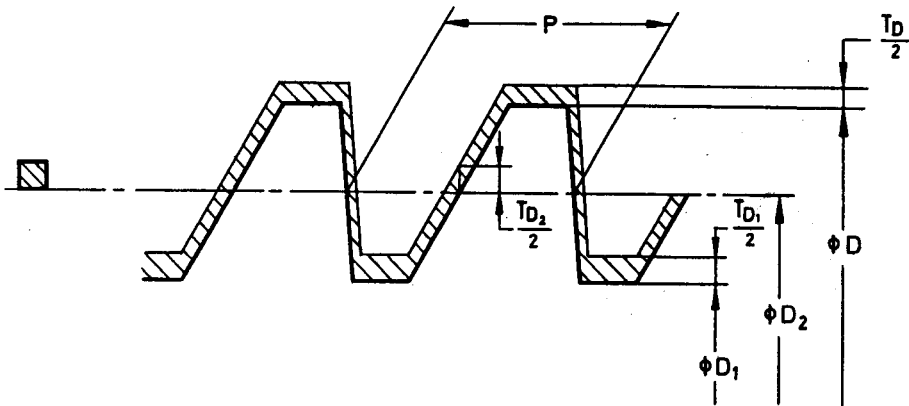


FIG. 1 INTERNAL THREADS WITH TOLERANCE POSITION *H*

**Table 2 Length of Threads Engagement**

(Clause 5.1)

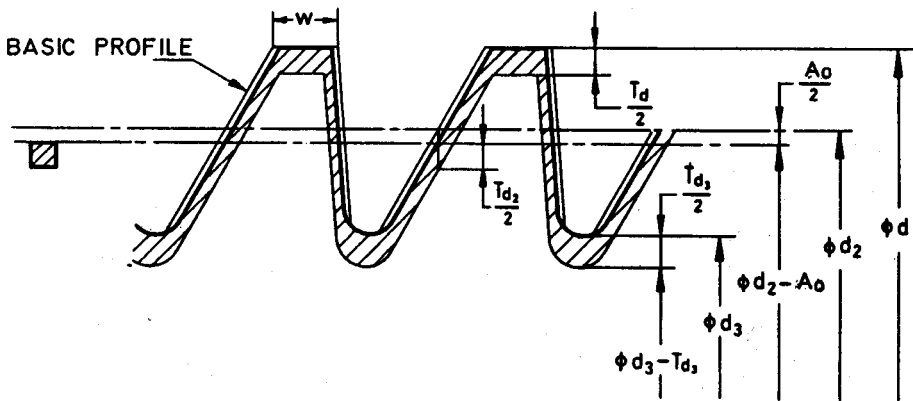
All dimensions in millimetres.

Nominal Diameter, $d$		Pitch $P$	Length of Threads Engagement		
			$N$		$L$
Over	Up to and Including		From	Up to and Including	Over
5.6	11.2	2	6	19	19
		3	10	28	28
11.2	22.4	2	8	24	24
		3	11	32	32
		4	15	43	43
		5	18	53	53
		8	30	85	85
22.4	45.0	3	18	36	36
		5	21	63	63
		6	25	75	75
		7	30	85	85
		8	34	100	100
		10	42	125	125
		12	50	150	150
45	90	3	15	45	45
		4	19	56	56
		8	38	118	118
		9	43	132	132
		10	50	140	140
		12	60	170	170
		14	67	200	200
		16	75	236	236
		18	85	265	265
90	180	4	24	71	71
		6	36	106	106
		8	45	132	132
		12	67	200	200
		14	75	236	236
		16	90	265	265
		18	100	300	300
		20	112	335	335
		22	118	355	355
		24	132	400	400
		28	150	450	450



Table 2 (Concluded)

Nominal Diameter, $d$		Pitch $P$	Length of Threads Engagement		
			$N$		$L$
Over	Up to and Including		From	Up to and Including	
180	355	8	50	150	150
		12	75	224	224
		18	112	335	335
		20	125	275	275
		22	140	425	425
		24	150	450	450
		32	200	600	600
		36	224	670	670
		40	250	750	750
		44	280	850	850
355	640	12	87	260	260
		18	132	390	390
		24	174	520	520
		44	319	950	950



$A_0$  = Fundamental Deviation = Upper Deviation for External Thread on the Pitch Diameter.

FIG. 2 EXTERNAL THREADS WITH TOLERANCE POSITION  $c$  OF PITCH DIAMETER AND  $h$  FOR MAJOR AND MINOR DIAMETER

5.2 For each pitch within a certain diameter range, basic major diameter  $d$  has been set equal to the smallest diameter in this range.

Length of engagement =  $\frac{\text{From } 2.24 P d^{0.2} \text{ to } 6.7}{\text{of group } N} P d^{0.2}$

Length of engagement =  $\frac{\text{Over } 6.7 P d^{0.2}}{\text{of group } L}$

Where  $N$ ,  $L$ ,  $P$  and  $d$  are in millimetres.

6 TOLERANCES

6.1 The tolerances for minor diameter of internal threads  $T_{D_1}$  for Grade 4 are calculated from the formula:

$T_{D_1} = 0.63 (230 P^{0.7})$

where

$T_{D_1}$  in  $\mu\text{m}$ , and

$P$  in mm.

6.1.1 The tolerances for minor diameter  $T_{D_1}$  are given in Table 3.

Table 3 Minor Diameter Tolerances  $T_{D_1}$

Values in  $\mu\text{m}$ .

Pitch $P$ mm	$T_{D_1}$ for Tolerance Grade 4
2	236
3	315
4	375
5	450
6	500
7	560
8	630
9	670
10	710
12	800
14	900
16	1 000
18	1 120
20	1 180
22	1 250
24	1 320
28	1 500
32	1 600
36	1 800
40	1 900
44	2 000

6.2 The tolerances for major diameter of internal threads,  $T_D$  are given in Table 4.

Table 4 Tolerances for Major Diameter of Internal Threads,  $T_D$

Values in  $\mu\text{m}$ .

Nominal Diameter mm		$T_D$ H10
Over	Up to and Including	
6	10	58
10	18	70
18	30	84
30	50	100
50	80	120
80	120	140
120	180	160
180	250	185
250	315	210
315	400	230
400	500	250
500	630	280

6.3 The tolerances for major diameter of external threads,  $T_d$  are given in Table 5.

Table 5 Major Diameter Tolerances,  $T_d$  of External Threads

Values in  $\mu\text{m}$ .

Nominal Diameter mm		$T_d$ h9
Over	Up to and Including	
6	10	36
10	18	43
18	30	52
30	50	62
50	80	74
80	120	87
120	180	100
180	250	115
250	315	130
315	400	140
400	500	155
500	630	175

6.4 The tolerances for minor diameter of external threads,  $T_{d_3}$  are given in Table 6.

6.4.1 The minor diameter tolerances,  $T_{d_3}$  are calculated from the formula:

$$T_{d_3} = (1.25 T_{d_2}) + A_0$$

where

$A_0$  is absolute value,  $T_{d_2}$  and  $T_{d_3}$  in  $\mu\text{m}$ .

6.5 The tolerances for pitch diameter of internal threads,  $T_{D_2}$  are given in Table 7 and for pitch diameter of external threads,  $T_{D_2}$  in Table 8.

6.5.1 *Tolerances for Pitch Diameter of Internal Threads,  $T_{D_2}$*

The tolerances  $T_{D_2}$  for grades given in Table 7 are obtained from  $T_{d_2}$  (6) values according to the table given below:

Tolerance Grade		
7	8	9
$1.25 T_{d_2} (6)$	$1.6 T_{d_2} (6)$	$2 T_{d_2} (6)$

6.5.2 *Tolerances for Pitch Diameter of External Threads,  $T_{d_2}$*

The tolerances  $T_{d_2}$  for grade 6 are calculated from formula:

$$T_{d_2} = 90 P^{0.4} d^{0.1}$$

Where  $d$  is the geometrical mean of the nominal diameter range in mm, in  $T_{d_2}$  is  $\mu\text{m}$ , and  $P$  is in mm.

6.5.2.1 The tolerances  $T_{d_2}$  for other grades given in Table 8 are obtained from  $T_{d_2}$  (6) values according to the table given below:

Tolerance Grade		
7	8	9
$1.25 T_{d_2} (6)$	$1.6 T_{d_2} (6)$	$2 T_{d_2} (6)$

## 7 RECOMMENDED TOLERANCE CLASSES

In order to reduce the number of gauges and tools; the tolerance classes should preferably be chosen from

Table 9 and 7.1, 7.2, 7.3 and 7.4. If the thread engagement group is not known, group (N) is recommended. Threading tools and gauges shall always be marked with the tolerance class in order to differentiate with the old tools.

7.1 For minor diameter of internal threads,  $T_{D_1}$  tolerance class shall be 4H [see IS 919 (Part 1)].

7.2 For major diameter of external threads,  $T_d$  tolerance class shall be h9 [see IS 919 (Part 1)].

7.3 For major diameter of internal threads,  $T_{D_1}$  tolerance class shall be H10 [see IS 919 (Part 1)].

7.4 Minor diameter tolerance of external threads,  $T_{d_3}$  is dependent on the pitch diameter tolerance  $T_{d_2}$  (see 6.4.1).

**Rounding Rules** — The major, pitch and minor diameter tolerance values are to be calculated using the formulae given in the above clauses and then rounded to the nearest value of the R 40 series of preferred number, except for the tolerance  $T_{d_3}$  for the minor diameter of the external thread.

## 8 TOLERANCES FOR MULTIPLE START THREADS

For multiple start threads, pitch  $P$  is taken as the basis for the fundamental deviation  $A_0$  and minor diameter tolerance for internal threads  $T_{D_1}$ . The tolerances of pitch diameter for internal threads  $T_{D_2}$  and external threads  $T_{d_2}$  of multiple start threads with lead  $pH$  (axial advance at one turn) are increased. The tolerances for the pitch diameter of single start threads are multiplied by a factor connected to and integer, from the preferred number series R 20 as given below:

Number of Starts	1	2	3	4	5 and Over
R 20 factor	1	1.12	1.25	1.4	1.8

If multiple start threads with greater pitches are required and the tolerances  $T_{D_2}$  and  $T_{d_2}$  from Table 7 and Table 8 are no longer applicable to them then the values for  $T_{D_2}$  and  $T_{d_2}$  shall be calculated from the formulae given at 6.5.1 and 6.5.2.

Table 6 Minor Diameter Tolerances,  $T_{d_j}$  for External Threads

(Clause 6.4)

Values in  $\mu\text{m}$ .

Nominal Diameter mm		Pitch $P$ mm	$T_{d_j}$ for Tolerance Position 'c' of Pitch Diameter for Tolerance Grade			$T_{d_j}$ for Tolerance Position 'e' of Pitch Diameter for Tolerance Grade		
Over	Up to and Including		7	8	9	7	8	9
5.6	11.2	2	388	445	525	309	366	446
		3	435	501	589	350	416	504
11.2	22.4	2	400	462	544	321	383	465
		3	450	520	614	365	435	529
		4	521	609	690	426	514	595
		5	562	656	775	456	550	669
		8	709	828	965	576	695	832
22.4	45	3	482	564	670	397	479	585
		5	587	681	806	481	575	700
		6	655	767	899	537	649	781
		7	694	813	950	569	688	825
		8	734	859	1 015	601	726	882
		10	800	925	1 087	650	775	937
		12	866	998	1 223	691	823	1 048
45	90	3	501	589	701	416	504	616
		4	565	659	784	470	564	689
		8	765	890	1 052	632	757	919
		9	811	943	1 118	671	803	978
		10	831	963	1 138	681	813	988
		12	929	1 085	1 273	754	910	1 098
		14	970	1 142	1 355	805	967	1 180
		16	1 038	1 213	1 438	853	1 028	1 253
		18	1 100	1 288	1 525	900	1 088	1 320
90	180	4	584	690	815	489	595	720
		6	705	830	986	587	712	868
		8	796	928	1 103	663	795	970
		12	960	1 122	1 335	785	947	1 160
		14	1 018	1 193	1 418	843	1 018	1 243
		16	1 075	1 263	1 500	890	1 078	1 315
		18	1 150	1 338	1 588	950	1 138	1 388
		20	1 175	1 363	1 613	962	1 150	1 400
		22	1 232	1 450	1 700	1 011	1 224	1 474
		24	1 313	1 538	1 800	1 074	1 299	1 561
		28	1 388	1 625	1 900	1 138	1 375	1 650

Table 6 (Concluded)

Nominal Diameter mm		Pitch <i>P</i> mm	<i>T<sub>d3</sub></i> for Tolerance Position 'c' of Pitch Diameter for Tolerance Grade			<i>T<sub>d3</sub></i> for Tolerance Position 'e' of Pitch Diameter for Tolerance Grade		
Over	Up to and Including		7	8	9	7	8	9
180	355	8	828	965	1 153	695	832	1 020
		12	998	1 173	1 398	823	998	1 223
		18	1 187	1 400	1 650	987	1 200	1 450
		20	1 263	1 488	1 750	1 050	1 275	1 537
		22	1 288	1 513	1 775	1 062	1 287	1 549
		24	1 363	1 600	1 875	1 124	1 361	1 636
		32	1 530	1 780	2 092	1 265	1 515	1 827
		36	1 623	1 885	2 210	1 343	1 605	1 930
		40	1 663	1 925	2 250	1 363	1 625	1 950
		44	1 755	2 030	2 380	1 440	1 715	2 065
		12	1 035	1 223	1 460	870	1 058	1 295
		18	1 238	1 462	1 725	1 038	1 263	1 525
355	640	24	1 363	1 600	1 875	1 124	1 361	1 636
		44	1 818	2 155	2 530	1 503	1 840	2 215

Table 7 Pitch Diameter Tolerances *T<sub>D2</sub>* for Internal Threads  
(Clauses 6.5, 6.5.1 and 8)

Values in  $\mu\text{m}$ .

Nominal Diameter mm		Pitch <i>P</i> mm	<i>T<sub>D2</sub></i> For Tolerance Grade		
Over	Up to and Including		7	8	9
5.6	11.2	2	250	315	400
		3	280	355	450
11.2	22.4	2	265	335	425
		3	300	375	475
		4	355	450	560
		5	375	475	600
22.4	45	8	475	600	750
		3	335	425	530
		5	400	500	630
		6	450	670	710
		7	475	600	750
		8	500	630	800
		10	530	670	850
		12	560	710	900

Table 7 (Concluded)

Nominal Diameter mm		Pitch <i>P</i> mm	<i>T<sub>D1</sub></i> For Tolerance Grade		
Over	Up to and Including		7	8	9
45	90	3	355	450	560
		4	400	500	630
		8	530	670	850
		9	560	710	900
		10	560	710	900
		12	630	800	1 000
		14	670	850	1 060
		16	710	900	1 120
		18	750	950	1 180
		4	425	530	670
		6	500	630	800
		8	560	710	900
90	180	12	670	850	1 060
		14	710	900	1 120
		16	750	950	1 180
		18	800	1 000	1 250
		20	800	1 000	1 250
		22	850	1 060	1 320
		24	900	1 120	1 400
		28	950	1 180	1 500
		8	600	750	950
		12	710	900	1 120
		18	850	1 060	1 320
180	365	20	900	1 120	1 400
		22	900	1 120	1 400
		24	950	1 180	1 500
		32	1 060	1 320	1 700
		36	1 120	1 400	1 800
		40	1 120	1 400	1 800
		44	1 250	1 500	1 900
355	640	12	760	950	1 200
		18	900	1 120	1 400
		24	950	1 180	1 480
		44	1 290	1 610	2 000

Table 8 Pitch Diameter Tolerance,  $T_{d_2}$  for External Threads

(Clauses 6.5, 6.5.2.1 and 8)

Values in  $\mu\text{m}$ .

Nominal Diameter mm		Pitch $P$ mm	$T_{d_2}$ For Tolerance Grade			
Over	Up to and Including		6	7	8	9
5.6	11.2	2	150	190	236	300
		3	170	212	265	335
11.2	22.4	2	160	200	250	315
		3	180	224	280	355
		4	212	265	335	400
		5	224	280	355	450
		8	280	355	450	560
22.4	45	3	200	250	315	400
		5	236	300	375	475
		6	265	335	425	530
		7	280	355	450	560
		8	300	375	475	600
		10	315	400	500	630
		12	335	425	530	710
45	90	3	212	265	335	425
		4	236	300	375	475
		8	315	400	500	630
		9	335	425	530	670
		10	335	425	530	670
		12	375	475	600	750
		14	400	500	630	800
		16	425	530	670	850
		18	450	560	710	900
90	180	4	250	315	400	500
		6	300	375	475	600
		8	335	425	530	670
		12	400	500	630	800
		14	425	530	670	850
		16	450	560	710	900
		18	470	600	750	950
		20	475	600	750	950
		22	500	630	800	1 000
		24	530	670	850	1 000
		28	560	710	900	1 120

Table 8 (Concluded)

Nominal Diameter mm		Pitch <i>P</i> mm	<i>T</i> <sub>12</sub> For Tolerance Grade			
Over	Up to and Including		6	7	8	9
180	355	8	355	450	560	710
		12	425	530	670	850
		18	500	630	800	1 000
		20	530	670	850	1 060
		22	530	670	850	1 060
		24	580	710	900	1 120
		32	630	800	1 000	1 250
		36	670	850	1 060	1 320
		40	670	850	1 060	1 320
		44	710	900	1 120	1 400
355	640	12	450	560	710	900
		18	530	670	850	1 060
		24	560	710	900	1 120
		44	760	950	1 220	1 520

Table 9 Recommended Tolerance Classes  
(Clause 7)

Tolerance Class for Pitch Diameter	Threads Engagement Group			
	Internal Threads		External Threads	
	N	L	N	L
Medium	7H	8H	7e	8e
Coarse	8H	9H	8c	9c



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